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Massachusetts
Regional Recycling
Program



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A Strategy for Regional Recycling

Prepared by:
Bureau of Solid Waste Disposal

*Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering*

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A STRATEGY FOR REGIONAL RECYCLING

TABLE OF CONTENTS

1. Executive Summary	P. 1
2. Regional Recycling Strategy Proposal to Communities	P. 5
3. Materials Recovery Facility (MRF) Feasibility Study	P. 14
4. Preliminary Market Report for Recycled Tin, Glass, and Paper	P. 23
5. Questions and Answers About the Regional Recycling Strategy	P. 39
6. Appendices:	
Appendix I: A Massachusetts Recycling Report	P. 47

EXECUTIVE SUMMARY

Recycling has gained increasing prominence in recent years as the most cost effective and environmentally sound method of trash disposal.

Across the country--most notably in New Jersey, Oregon, California, Nebraska, and Minnesota--substantial commitments to waste management through recycling have been made at the state level.

Massachusetts is facing a solid waste disposal crisis. More than 80 percent of the 6 million tons of trash generated in the state each year is currently disposed of in landfills. Yet landfill capacity is rapidly diminishing: 75% of the active landfills will run out of space by 1990. And landfills pose a serious environmental threat. Chemical leachate migrating from at least 40 percent of the dumps is polluting or threatening to pollute surface and ground waters.

For communities in Massachusetts that are using nonpolluting state-of-the-art landfills, disposal costs range from \$20 to \$35 per ton. That range is expected to jump to \$50 to \$60 per ton within the next five years.

For economic, planning and environmental reasons, Massachusetts communities must begin to look seriously at recycling as a solid waste management strategy if a trash disposal crisis is to be averted. While recycling in the past has been viewed as a "nice thing" for volunteers to do on weekends, it must now become an integral component of the solid waste management system. Recycling must move from the church halls and cub scout dens to the offices of public works directors.

The Commonwealth is embarking on a statewide recycling program which ultimately aims to recycle 25% of the waste stream.

PROBLEMS OF THE PAST

Only 5% of the waste stream in Massachusetts is currently recycled, either through local recycling programs or the Bottle Law. Approximately 70 communities have some form of recycling program. Many of these began in the early 1970s, as part of the environmental movement. However, the effectiveness of all these efforts as a solid waste disposal strategy has been minimal. All local programs together recycle less than one percent of the waste stream. Despite years of dedicated effort, many local programs fail.

Low volume and low quality are the two major reasons small, voluntary programs cannot secure stable markets. Small programs usually do not generate the quantity of recycled materials necessary to make shipment to markets worthwhile. And they cannot guarantee the high quality essential to make them attractive to industries that buy secondary or recycled materials.

RECYCLING PROCESSING FACILITIES: THE MISSING LINK

The "missing link" between the communities and the industries is a process which would collect recyclables from many communities and upgrade them into high-quality feedstocks for industry.

The lack of assistance to communities in processing and marketing their recyclables has prevented recycling from becoming an effective component of the solid waste management system. The state is proposing to address this deficiency by financing an infrastructure of intermediate processing facilities across the Commonwealth.

These plants, called Materials Recovery Facilities or MRFs, will purchase a community's recyclables for approximately \$5 per ton. They will then process recyclables into high quality raw materials for sale to end user industries.

REGIONAL RECYCLING PROGRAMS: STATE AND LOCAL COOPERATION

In the beginning, the state will launch regional recycling programs in several parts of the Commonwealth. Communities that choose to participate in the program must pass local recycling ordinances that require separation of garbage by residents and businesses; curbside collection of recyclables at least twice a month; and delivery of recyclables to the nearest MRF. The communities, in cooperation with the state, will also develop programs to educate people about the benefits of recycling.

Source separation will be of the easiest type: glass, aluminum and tin containers in one bag; paper in another; and regular garbage in a third. In communities with curbside collection, all will be placed at the curbside for collection. Studies have shown that on average 65% of a community's residents and businesses participate in a recycling program after passage of a mandatory ordinance. Virtually no enforcement is required. A community can easily recycle 15% of its waste under such a program.

For its part, the state will: 1) offer technical assistance to help communities develop the most efficient collection

systems; 2) provide grants to communities to pay for capital equipment required for the curbside collection and to develop a publicity campaign to educate community residents; 3) construct the MRFs and select experienced and responsible operators; 4) help the MRFs identify markets and attract "end user" industries to the state and; 5) eventually develop a statewide marketing cooperative among the MRFs; and finally provide technical assistance in developing programs that can recycle additional materials such as tires, plastic and yard waste.

GETTING MATERIALS READY FOR THE MARKET

The state will build MRFs in areas where a number of communities--with a combined population of 200,000 or more--have passed mandatory recycling ordinances or bylaws. Each MRF will process approximately 160 tons of recyclables per day, or 40,000 tons per year. The facilities will take two streams of recyclables -- cans and glass in one stream, paper in another -- and will process them into high quality "secondary" materials for sale to "end user" industries.

At the MRF, glass will be sorted by color; de-labelled, cleaned and crushed into smooth pebbles called "cullet"; then shipped to glass companies, where it will replace sand and soda ash as raw material for making new glass containers.

Tin cans will be de-labelled, cleaned and flattened; then sold to de-tinning plants. Aluminum will be baled and sold to aluminum processing facilities.

Paper will be sorted, baled, and sold to recycled-fiber mills or national paper brokers, where it will be used to make paperboard and other materials.

STRONG MARKET DEMAND

There is a strong demand for processed recyclables. A preliminary market study by the Bureau of Solid Waste Disposal found that the market for processed recyclables--rather than, unprocessed recyclables--can easily absorb all the tin, glass and paper generated by the Massachusetts MRF program in its early stages. The study also indicates that the market will continue to be strong for the much larger quantities that will be generated as the program grows.

A demand large enough to support the output of 40 MRFs exists for tin cans. There is also a very large available demand for "flint" or clear glass, with a smaller market for green and amber glass (much of this glass is already covered by the Bottle Law). The rapidly industrializing nations, with a heavy demand

for paper packaging matched with a relatively low supply of domestic paper fiber, form the basis of a strong export market for recycled paper, one that could conceivably absorb the output of 15 MRFs.

CONTENTS OF THE PACKET

This report contains the documents that have led to the development of the Commonwealth's regional recycling strategy.

The Regional Recycling Strategy Proposal to Communities describes the program for local communities and tells them how they can participate in a state-sponsored program in their region. This report will be edited to carry specific data for each municipality to which it may be sent.

The Materials Recovery Facility (MRF) Feasibility Study describes the MRF technology and provides projected income statements and capital expenses for a typical 160 ton per day plant. It also contains a general plant design.

The Preliminary Market Report was compiled by Bureau staff in direct meetings with end user-industries over a three-month period ending in May, 1985. In addition to the market summaries for each material, letters from representative individual markets have been appended as further documentation.

Questions and Answers About the Regional Recycling Strategy is a collection of questions that have been asked about the regional recycling strategy during its development, and answers to these questions. The issues addressed have been raised by staff, by members of the advisory committees that have worked with the Bureau, and by other agencies that have reviewed the plan.

The Massachusetts Recycling Report is included as Appendix 1. It is the original background and planning document that led to the regional recycling strategy.

**Regional Recycling Project
Proposal to Communities**

Regional Recycling Strategy Proposal to Communities

I. Recycling as a Solid Waste Management Strategy

Recycling has recently moved into new prominence as a solid waste management strategy. In many states--notably New Jersey, Oregon, Nebraska, Minnesota, and Wisconsin--substantial commitments to waste management through recycling have been made in the last three years.

Rising real estate values and increased emphasis on environmental protection have brought the problems of landfilling into sharp focus. Like Massachusetts, other states are "running out of space". Like Massachusetts, both residents and public officials are becoming increasingly concerned about contamination of ground and surface waters by active and inactive land burial sites.

In New Jersey, more than 10 percent of the waste generated in the state is currently recycled. In selected cities across the country, the diversion rate is even more striking. San Francisco recycles 22% of its total waste stream; Seattle recycles 18%; Austin, Texas diverts 20%. In comparison, Massachusetts recycles about 5%, mostly due to the Bottle Law. (All of the small, local programs combined, recycle less than one percent of the waste stream in Massachusetts).

Returning discarded materials to industry is the most cost-effective waste management strategy. In studies performed for cities and states across the country, recycling has been demonstrated to be the most cost effective solid waste disposal option available.

The Commonwealth is embarking on a program to help communities reduce and manage their solid waste. The outline of this program includes the following components, explained more fully below.

1. State development and financing of regional materials recovery facilities (MRFs). These facilities will process and market the recyclables collected by participating communities or their commercial haulers.

2. State planning and financial assistance to communities to develop cost effective curbside recyclables collection programs.

3. State assistance to communities to develop recycling educational materials and programs for households, schools, and commercial waste generators.

4. Passage of municipal recycling ordinances, which will require source separation of trash and curbside collection of recyclables.

II. The State's Regional Recycling Plan.

1. Source Separation.

Recycling as a solid waste management method occurs when items that have become waste are diverted from the waste stream, collected, processed, and then reintroduced into the economic mainstream as feedstocks for manufacturing processes.

Under the proposed plan, residents and businesses must separate all glass bottles and jars and all aluminum and tin cans into one bag; all newspapers, magazines and other paper into another; and regular trash into a third. The three containers will be placed at the curbside for collection.

This is source separation of a simple and easy type--a far cry from earlier recycling programs that required complicated separation into 8 or even 10 categories. Experience in other states has shown that 65% of a community's residents and businesses will participate in such a program, once a municipal recycling ordinance has been passed.

These ordinances require recyclables to be separated from the regular trash by households and businesses and to be collected at the curbside by municipal or contracted haulers. Based on the percentage of recyclables in the waste stream, if 65% of the community's residents separate their garbage in this simple way, 15-20% of the total waste stream in that community will be diverted from either land disposal or waste-to-energy facilities.

2. Curbside Collection

The state will provide two services to assist participating communities in developing the most efficient and cost effective collection systems possible. First, the state will offer technical assistance to help determine the most effective collection method for a particular community. Second, the state will provide grants to pay for any capital equipment required by the curbside collection ordinance.

3. Processing and Marketing

After recyclables are collected from the curb, they must then be upgraded, to meet the specifications of the industries willing to buy them. This upgrading will be performed by intermediate processing equipment, located in a materials recovery facility (MRF). The Commonwealth plans to construct MRFs in a couple of selected regions first, and eventually throughout the state.

a. What is a Materials Recovery Facility or MRF?

A materials recovery facility (MRF) is an intermediate processing center which processes waste materials into industrial feedstocks. Most intermediate processing involves simple, labor-intensive sorting, densifying and cleaning.

The MRF technology under consideration by the state receives recyclables separated into two "streams"--glass and metal containers in one stream; paper in another. The containers pass along a conveyor and the ferrous metals are removed magnetically. Nonferrous metals and glass are hand-picked and directed into densifying equipment. The equipment removes the labels and caps from the glass containers as it cleans and crushes them. The cans are de-labelled and then flattened or shredded by can processing equipment. The resulting "secondary materials" are of a high quality and thus attractive to end-user markets.

The paper stream will either be sold as mixed paper or processed into three grades of paper, depending upon markets. The first two MRFs will probably differ in their handling of paper, to explore the advantages of each option. One regional project will produce baled newsprint, corrugated, and low-grade mixed paper. Another regional program may simply deliver unsorted and unbaled paper to a recycled fiber mill or a paper-stock broker; it will either be processed or used as is.

b. Ownership/Financing of the MRFs.

The state is investigating options for financing, developing and operating the MRFs. The two initial regional programs will involve State ownership and private operation of some type. Surpluses from the MRFs will be shared by the operator, the communities, and the state.

c. Marketing.

Marketing of materials generated through the regional program will initially be done by the MRF operator, with state assistance. As more MRFs are built, a statewide marketing cooperative will be developed to coordinate the marketing functions. A market study prepared by the state indicates that there is currently a stable market demand for the materials that would be generated by at least ten plants, taking in 40,000 tons of recyclables per year and operating at full capacity. The sole marketing responsibility of the municipalities will be to deliver the materials to the MRF in two streams, as specified in the agreement between the municipality and the MRF.

d. Economics of the MRFs

The MRF will pay participating municipalities for each ton of waste recycled at the MRF. The exact amount will be negotiated between the MRF operator, the state, and the communities.

Based on the projected MRF operating statements contained in the MRF Feasibility Study, communities can expect to recover approximately (ballpark estimate only) \$5 for each ton of recyclables they deliver to the MRF. This payment will add to avoided disposal cost. Together, the avoided disposal cost and revenue from the sale of recyclables will provide the community with a substantial economic incentive.

IV. What Makes Recycling Work?

Recycling works for municipalities when there is some direct benefit to be gained from it. In Massachusetts the two benefits for municipalities that enter into a regional program are (1) avoided costs of disposal, and (2) revenue from sale of recyclables at the MRF, based on the tonnage the municipality has recycled at the MRF.

One reason for the "poor track record" of local, voluntary recycling programs is that their costs have been computed outside of the costs of the solid waste system. Recycling programs,

because they haven't been seen as solid waste management strategies, have had to "pay their own way," a requirement not applied to landfills or incinerators. Recycling should be considered to be "working successfully" if it reduces the cost of managing garbage, even if the materials recycled generate no income at all.

In the past, many recycling programs have failed because there has been no institutional support structure. The recycling programs which did not succeed in Massachusetts over the past fifteen years were all operating without a statewide materials recovery infrastructure and market development program.

Local programs generate small quantities and have limited ability to find markets and bring materials up to specifications demanded by those markets. Without a state infrastructure, program success and longevity have been elusive. The current plan for state/local cooperation will create the support structure necessary for regional recycling programs to succeed.

V. Recycling and Energy Recovery

Recycling is receiving growing attention as a means improving the efficiency, cost-effectiveness, and performance of waste-to-energy facilities. Essex County New Jersey, in its landmark study, "The Integration of Materials and Energy Recovery in the Essex County Solid Waste Management Plan", investigated the BTU value of waste loads with 15 percent, 25 percent, and 35 percent of their materials removed through source separation. The study found that when glass, metal cans, and newsprint were removed, the BTU value of the waste increased. A 15 percent rate of removal resulted in a 6 percent increase in BTUs/ton over non-source-separated wastes. With 35% recycling rate BTU's per ton increased by over 11%. Glass and metal, because of their heat retention properties, had been taking heat out of the system. Essex County is currently recycling at a rate of more than 10%. The siting hearings for the Energy Recovery Facility are still going on, and the plant is expected to come on line by 1987.

There are important fiscal and technical reasons to integrate recycling ("materials recovery") with waste-to-energy systems ("energy recovery"). In brief, an integrated system produces:

1. Less abrasion on facility moving parts, resulting in lower maintenance costs.
2. More BTU's per ton; i.e. better fuel quality.

3. Decreased amount of residue ash to be landfilled.
4. Consistent combustion temperatures, resulting in decreased emissions.
5. Decreased heavy metals in emissions, because metals have been removed from the burn process.
6. Increased efficiency of front-end materials handling, because the incoming waste is more homogeneous.

VI. Participation in the State Program

In order to participate in the Regional Recycling Program, municipalities will be asked to make a commitment to the project by agreeing to:

1. pass a mandatory source separation ordinance;
2. publicize the program and educate residents;
3. collect the target materials, or contract for their collection;
4. deliver those materials to the MRF.

The Commonwealth's responsibilities to communities participating in the Regional Recycling Programs will be:

1. develop a regional Materials Recovery Facility;
2. provide technical assistance to evaluate collection options;
3. plan educational campaigns and supply prototypical educational materials;
4. provide recycling equipment grants.

In cooperation, the state and local communities can create the kind of effective recycling solid waste management methods that have eluded local communities working on their own.

APPENDIX I: COST-BENEFIT ANALYSIS OF REGIONAL RECYCLING

Participation in the Commonwealth's Regional Recycling Strategy can yield significant savings for municipalities. The following analysis outlines, in dollar terms, the costs and benefits of participation by a community of 50,000 people that has a municipal contract for trash collection and disposal with a private hauler.

Population = 50,000

Total Garbage Generated = 50,000 tons per year*

Assumptions:

1. With mandatory source separation and the availability of a MRF, the diversion rate will be 15%. The town must now dispose of only 42,500 tons of garbage and will sell 7,500 tons of recyclables to the MRF.
2. Collection costs are \$20/ton.
3. Disposal and transportation costs are \$30/ton.

WITHOUT RECYCLING:

Costs:

Collection Costs: 50,000 tons x \$20/ton = \$1,000,000

Disposal and
Transportation Costs: 50,000 tons x \$30/ton = \$1,500,000

Total Costs = \$2,500,000

Benefits:

Revenue From Sale of Recyclables: = \$0

Total Benefits = \$0

Net Cost: \$2,500,000

*Assumes that each resident generates an average amount of one half ton of trash per year. Also assumes that residential trash accounts for approximately one half of the waste stream and commercial trash one half. Therefore, for an average community we doubled the residential figure to obtain the total amount of solid waste generated.

WITH RECYCLING:

Costs:

Collection Cost: 50,000 tons x \$22/ton = \$1,100,000
Disposal and
Transportation Costs: 42,500 tons x \$30/ton = \$1,275,000
Total Costs = \$2,375,000

Benefits:

Avoided disposal costs of \$225,000 included
above as a decrease in the amount of garbage
that needs to be disposed of from 50,000 tons
to 42,500 tons.

Revenue from sales of
Recyclables to a MRF: 7,500 tons x \$5/ton = \$37,500
Total Benefits = \$37,500

Net Cost: \$2,337,500

NET COST WITHOUT RECYCLING: \$2,500,000
NET COST WITH RECYCLING: \$2,337,500

TOTAL SAVING FROM RECYCLING: \$162,500

Notes: Collection costs will increase by approximately 10% (or \$100,000 per year) with the addition of twice-per-month collection of recyclables. This estimate accounts for both the depreciation of new equipment needed and the added labor costs. In a similar program in Connecticut, collection costs increased by 15% with the addition of weekly collection of recyclables.

Transportation costs should not rise significantly because the MRF will be located at or near where the community is currently taking its trash.

Materials Recovery Facility Feasibility Study

MATERIALS RECOVERY FACILITY:
PROJECTED OPERATING EXPENSES AND REVENUES
PROJECTED CAPITAL COST

Introduction:

The following operating expense and revenue and capital cost projections are for a 160 tons per day capacity materials recovery facility (MRF), that receives and processes mixed recyclables from municipal curbside collection programs. The materials are delivered to the MRF by the collection vehicles, or in some cases, by transfer trailers. The recyclables are brought in two streams, a glass-and-cans stream (80 tons per day) and a paper stream (also 80 tons per day). These streams represent the total separation required of residents: two "things" to put at the curb, in addition to garbage.

The role of the MRF is to receive and process the mixed recyclables, and then to market them to industry. The MRF-produced secondary commodities are of a quality that makes them attractive feedstocks to manufacturing industry.

Processing Technology:

The materials recovery facility described here is a labor-intensive mechanized system. The two streams are handled differently, as described below.

1. Glass and Cans:

Glass and cans are brought to the MRF in open container vehicles: trailers, dump trucks, or other trucks. At the MRF they are dumped into a "pit", which feeds a conveyor. The containers travel along the conveyor and through a magnetic separator, where the ferrous cans are diverted into a can processor. Ferrous cans are cleaned, flattened, and de-labelled mechanically, and stored for shipping.

Non-magnetic materials--glass and aluminum, as well as plastics, ceramics, and other contaminating materials--travel further along the original conveyor, where "pickers" select target materials. In the first station, flint (clear) glass is selected and dropped into a feed hopper for a glass crusher. Amber glass is extracted at the second station, flint again at the third and green at the fourth. Aluminum cans may also be selected, as can other salvageables (such as household aluminum scrap). Whatever materials are not selected "fall off" the end of the conveyor and into a waste container: they are landfilled. This unselected portion represents about 15% of the original volume of collected cans and bottles.

The materials that are selected are processed. Glass is crushed in such a way as to ensure that no particles of foil, metal, paper, or plastic (which are contaminants) adhere to the glass fragments, which then fall through a screen, ensuring that their size is uniform. The resulting material, called "cullet", is a furnace-ready feedstock. It may be shipped by rail or by truck to end-user industries. It may also be used as a substitute for sand in construction applications.

The flattened tin cans are shipped to a detinning mill, where the tin is extracted through chemical reclamation. The resulting steel is also of high value to the steel industry.

The aluminum cans are also flattened and sold to aluminum beverage container manufacturers, where they can be re-used to make can sheet with only minor re-alloying.

The MRF described here can process 80 tons of mixed containers per day.

2. Paper

Paper can be handled in several ways in the MRF. It too is delivered and dumped. Then it may be hand or conveyor handled, and directed to a baler, baled, and stored indoors on pallets. Corrugated paper, collected separately or delivered by commercial haulers, would be baled at different times, so that the two types would not get mixed. If local market capacity is compatible with delivery of loose paper, this is an option that could be considered. In that case, the loose paper would be loaded--by loader or by conveyor--into an open-top container.

Transportation

Transportation is done by contract, using backhauls wherever possible. Processed materials may move by truck, by rail, or potentially by barge.

Marketing

The market values described by the statements are for processed materials delivered to manufacturing plant. The materials would be marketed by the MRF operator.

Disposal

The rejected materials from the glass and can stream would be disposed of "conventionally", that is, either landfilled or directed to a resource recovery plant.

Income Statement

MATERIALS RECOVERY FACILITY: AVERAGE REVENUE FROM MIXED RECYCLABLES

Revenue Per Average Ton of Bottles and Cans

Materials	Percent of Average Ton Of Recyclables		Average Revenue Per Ton Of Listed Materials		Revenue Per Aver- age Ton
Glass					
Flint	41.25	x	\$42.00	=	\$17.33
Green	18.75	x	35.00	=	6.56
Amber	15.75	x	30.00	=	4.73
Tin	24.50	x	54.00	=	13.23
Aluminum	0.50	x	640.00	=	3.20
Total					\$45.04

Revenue Per Average Ton of Paper

Materials	Percent of Average Ton Of Recyclables		Average Revenue Per Ton Of Listed Materials		Revenue Per Aver- age Ton
Paper					
News	40.00%	x	\$50.00	=	\$20.00
Corrugated	20.00	x	50.00	=	10.00
Mixed	40.00	x	25.00	=	10.00
Total					\$40.00

MATERIALS RECOVERY FACILITY: PROJECTED REVENUES

MRF Capacity **Tons**

Bottles and Cans

Bottles and Cans Per Day	80
Bottles and Cans Per Year:	
(250 Operating Days)	20,000
Less: Waste Per Year @ 12%	2,400
Total Bottles and Cans	
Processed Per Year	17,600

Paper

Paper Per Day	80
Paper Per Year:	
(250 Operating Days)	20,000
Less: Waste Per Year @ 5%	1,000
Total Paper Processed Per Year	19,000

Revenues Per Year

Bottles and Cans @ \$45.04/ton	\$792,704
Paper @ \$40.00/ton	760,000
Total Revenue Per Year	\$1,552,704

MATERIALS RECOVERY FACILITY:
PRELIMINARY OPERATING EXPENSES AND REVENUES:
Annual Operating Expenses

LABOR:

Salaries

1 Plant Manager	\$22,000
1 Maintenance Person	18,000
4 Loader Operators @ 16,000 ea.	64,000
18 Sorters @ 12,000 ea.	<u>216,000</u>
Sub Total: Salaries	320,000

Benefits @ 25%	<u>80,000</u>
	400,000

NON-LABOR COSTS

Variable Costs:

Equipment repair and maintenance, fuel, and utilities	\$129,351
Management Costs	115,587
Plant Supplies	28,745
Raw Material	0
Shipping	287,450
Waste Removal and Disposal	<u>119,000</u>
Sub Total: Variable Costs	680,134

Fixed Costs:

Equipment Lease	\$36,000
Insurance	10,000
Office Supplies	2,000
Taxes: Property, Sales, Corporate	1,000
Telephone	<u>2,400</u>
Sub Total: Fixed Costs	\$51,400

TOTAL NON-LABOR COSTS \$731,534

TOTAL EXPENSES \$1,131,534

TOTAL REVENUES \$1,552,704

SURPLUS (LOSS) \$421,170

SURPLUS (LOSS) PER TON \$10.53

MATERIALS RECOVERY FACILITYPRELIMINARY CAPITAL COST: Bottle and Can Equipment and Conveyors

No.	Item	Price
	CONVEYORS - with hydro crown head and tail pulleys and with all necessary guards, sides supports, chutes, etc.	
4	Cullet - 18"W by 35'L with scalping magnets	\$28,432
1	Aluminum - 18"W by 25'L with magnetic separator	11,040
1	Aluminum - 18"W by 25'L	8,540
1	Main Feed - 30"W by 45'L with double magnetic separation and cleaning system	20,266
1	Sorter - 30"W by 60"L	9,736
1	Scrap - 30"W by 30'L	8,588
2	Tin can takeaway - 30"W by 35'L	15,500
1	Trash - under main feed - 30"W by 35'L	8,530
1	Trash - under baskets - 30" by 60'L	11,744
1	Trash - into roll off - 30"W by 30'L	8,942
1	Trash - from can machines - 18"W by 10'L	11,728
1	Loading conveyor - mobile	9,610
	Sub Total: Conveyors	\$152,656
2	Can Processors, Model 5	\$49,870
4	Glass Smashers, Model 8	56,200
1	Vibrating feed hopper	10,800
4	Glass Hoppers	2,000
1	Bucket for fork lift truck	2,000
1	Lot of spare parts	3,000
1	Set of tools	4,000
1	Lot of office equipment and supplies	3,000
	Sub Total: Processors, etc.	\$130,870
	Total:	\$283,526

MATERIALS RECOVERY FACILITY
PRELIMINARY CAPITAL COST: Summary

Bottle and Can Equipment and Conveyors	\$283,526
Paper Baler and Conveyors	231,000
Building and Paving (Estimated)	464,000
Installation	51,900
CAPITAL COST	<u>\$1,030,426</u>

Notes: Some expenses are not complete. Such items as procurement costs have been omitted, and others, such as electrical contracting, have only been estimated at this time. Such omissions are noted in the succeeding pages.

MATERIALS RECOVERY FACILITY

PRELIMINARY CAPITAL COST: Paper Baler and Conveyors

Item:	Price
American Baler	\$177,000
Paper Conveyor, Carl Schmidt of Denver	46,000
Trash conveyor	8,000
Total:	<u>\$231,000</u>

Depending on the equipment selected, we believe that installation costs for the above equipment will be covered by the facility installation costs. Procurement costs are also not included.

Another baler, the Balemaster, is also being considered.

MATERIALS RECOVERY FACILITY:

PRELIMINARY CAPITAL COST: Installation

Electrical wiring to motors, controls, panels, etc.	\$25,000
2 Professional personnel, 30 days	10,000
Lease fork lift truck, 30 days	900
Miscellaneous steel, nuts and bolts, sheet metal, chutes, support members, etc.	6,000
3 Laborers, local, 30 days	3,000
Gas for loader, utility bills and deposits, etc.	3,000
Security (depends on site)	4,000
Total:	51,900

Site factors such as codes, taxes etc. have not been investigated. Nor have local contractors, especially electrical contractors, been contacted. The need for security has not yet been evaluated. These costs will be refined when a specific site has been selected.

**Preliminary Market Report For
Recycled Tin, Glass, and Paper
Generated From the Massachusetts
Waste Stream**

Preliminary Market Report for Recycled Tin, Glass, and Paper Generated from the Massachusetts Waste Stream

Introduction:

The Bureau of Solid Waste Disposal, assisted by an outside consultant, has undertaken a preliminary survey of the marketability of the processed tin, glass and paper that would be produced by the state's proposed regional recycling projects.

Although the survey is not comprehensive, the results are very encouraging: current market demand will be able to absorb the output of the Massachusetts regional recycling projects for the foreseeable future.

1. Recyclables in the Waste Stream.

According to the Bureau's study, 5% of the Massachusetts waste stream is comprised of tin cans, 8% is non-bottle bill glass, and 15% is newspaper, corrugated and recyclable mixed paper. Given that the total amount of waste generated in Massachusetts is estimated at 6 million tons per year, recyclables reach the following levels:

Tin Cans	300,000 tons
Glass	480,000 tons (flint glass 55%, or 260,000 tons) (green glass 25%, or 120,000 tons) (amber glass 20%, or 96,000 tons)
Paper	900,000 tons (news, corrugated, mixed)

National studies have shown that on average 65% of a municipality's residents will separate their waste if the municipality has passed a mandatory source separation and curbside collection ordinance. Based on these participation rates, the Bureau estimates that eventually 75% of all tin and glass, and 50% of all mixed paper, could be diverted from the Massachusetts waste stream into recycling.

2. Processed Recyclables: The MRFs.

The proposed Massachusetts plan differs greatly from small, local programs, which have had limited success in the past. The key to enhancing success is the Materials Recovery Facility, or MRF. The MRF takes in raw recyclables, and processes them into a form more desirable to industry: labels are removed, bottles and cans are crushed, and paper is baled. The Commonwealth is proposing the construction of between 2 and 5 MRFs initially.

3. The Market Demand:

This survey was designed to find out how much available

demand exists in the end-user industries for processed, high quality recyclables. The following table compares the projected full-capacity operation output of the MRFs, with the amount of available market demand found in the survey.

The projections for MRF output were based on facilities which will process a total of 160 tons per day of mixed recyclables (glass, cans, and paper) or 40,000 tons per year.

Material	2 MRFs Tons Per Year	5 MRFs Tons Per Year	10 MRFs Tons Per Year	Available Demand Tons Per Year
Tin Cans	8,624	21,560	43,120	108,000
Glass				
Flint	14,500	36,000	72,000	250,000
Green	6,600	16,500	33,000	40,000
Amber	5,544	13,860	27,720	25,000
Paper	38,000	95,000	190,000	80,000

It should be emphasized that these findings are preliminary. Further examination is likely to disclose additional markets.

4. The Importance of Quality

Virtually every broker and end user emphasized the need for processed recyclables to be of a specific quality. In general, any contaminants (labels, etc.) severely limit the marketability of recyclables to industry. Accordingly, it is reasonable to conclude that successful marketing depends on, among other things, attaining the specific quality targets set by end users and brokers.

This plan proposes developing intermediate processing capacity at the Materials Recovery Facilities (MRF). This process has been used in a number of places across the country. According to end users and brokers contacted by this survey, the plan proposed by Massachusetts would indeed produce sufficiently high quality recyclables to ensure their marketability.

5. The High-Volume, High-Quality Approach:

In the past, recycling programs have been small-scale and have tried to market unprocessed recyclables. As a result, these programs do not have a good track record, particularly in the area of marketing their recyclables.

The reason for this is simple: end-user industries want a higher level of quality, and an assured, high-volume stream of processed recyclables. The Massachusetts regional recycling program, with its emphasis on high volume and high quality, will meet industry requirements. It should be noted that the technology proposed by the Commonwealth is already at work in other places, and operators have been able to successfully market their processed recyclables.

Preliminary Report on the Marketability of Tin Cans Recovered From the Massachusetts Waste Stream

Available Demand: 108,000 tons per year
2 MRF output: 8,624
5 MRF output: 21,560
10 MRF output: 43,120
Revenue Per Ton: \$54.00

Introduction: Nature and Desirability of Recycled Tin Cans

Tin cans are actually made of steel covered with a very thin coating of tin, which prevents to oxidation of the steel, and consequent spoilage of food. The tin coating must be removed to make the underlying steel useful to industry; so the market for recycled tin cans is a detinning plant. Detinning plants are the only domestic source of tin, and recycled tin is cheaper than mined, foreign tin. The steel scrap produced by a detinning plant is the highest quality steel scrap. It is an ideal charge for a mini-mill, and is highly valued because it is clean, has a known chemical composition, and melts at lower temperatures than virgin ore.

Surveyed Detinning Plants:

Vulcan Metals Co., Birmingham, Alabama.
Vulcan Metals operates detinning plants in Baltimore, Pittsburgh, and Gary, IN.

The Market for Recycled Tin Cans:

Representatives of Vulcan indicated that they currently have unfilled capacity of 108,000 tons per year. They also said that if greater tonnages could be collected and processed in Massachusetts, they would consider building a plant with a 120,000 ton per year capacity in the state. They emphasized that they need high quality cans, but if quality can be assured, they will use all the tin they can possibly get.

Comments:

Vulcan Metals is the only operator of detinning plants in the East, and so is the only potential buyer. Fortunately, Vulcan has been extremely receptive to the possibility of buying processed tin cans from the Massachusetts MRF system. Quality, defined in this case as a high degree of label removal, is important to Vulcan. Contaminants such as labels or organic matter decrease the tin yield from the detinning process.

Vulcan representatives emphasized that as tonnage increases, so must quality, especially with regard to removal of labels.

They have invested in developing a process to extract tin cans from raw garbage, but thus far have been unable to reach a high enough level of quality in two test cases where scrap tin was obtained from refuse-driven fuel (RDF) garbage burning plants. This is another argument for source separation rather than extraction of recyclables from raw garbage as many RDF technologies propose.

The MRF technology proposed would provide cans of acceptable quality for Vulcan. Vulcan currently pays \$62 per ton for high-quality crushed tin cans from a MRF.

Preliminary Report on the Marketability of Scrap Glass from the Massachusetts Waste Stream

	Flint	Green	Amber
Available Demand: (Tons Per Year)	250,000	40,000	25,000
2 MRF output:	14,500	6,600	5,544
5 MRF output:	36,000	16,500	13,860
10 MRF output:	72,000	33,000	27,720
Revenue Per Ton:	\$42.00	\$35.00	\$30.00

Introduction: The Nature and Desirability of Scrap Glass

Recycled or scrap glass is called cullet. Cullet is formed by crushing glass containers and removing such contaminants as stones, ceramics, metal, most paper labels, all aluminized labels, plastics, etc. In the type of processing technology under consideration by Massachusetts, cullet would be separated by color: flint (clear) glass, amber, and green. In the glass manufacturing process, cullet replaces the raw materials sand, soda ash, and limestone. Soda ash is in particularly high demand; it can only be obtained in Wyoming, and so shipping costs to New England are high.

Surveyed Cullet Users:

Foster Forbes, Milford, MA
Glass Container General Corporation, Dayville, CT
Owens-Corning Fibers, Delmar, NY
Domglass, Inc., Mississauga, Ontario
Consumers Glass, Toronto, Ontario
Robert Peloquin et Fils Ltee, Montreal, Quebec

The Market for Cullet:

The market for flint glass is the strongest, with 250,000 tons per year of demand identified. The markets for green and amber were smaller: 40,000 to 45,000 tons per year of demand for green glass and 25,000 tons per year of demand for amber glass were identified. It should be noted that the two largest markets for amber glass have yet to be surveyed.

Comments:

The Bottle Law has had a very large impact on the scrap glass market. It resulted in larger quantities of green and amber glass, used in beer bottles, being returned to the system rather than being landfilled, and accordingly the market for green and amber glass is in relative oversupply. This has also hurt local recycling programs, which lost their markets for green and amber glass to beverage distributors. The reverse is the case for flint

glass. Flint glass has been increasingly replaced by plastic containers for soft drink; plastic containers are much easier for retailers to store. Flint glass used in other containers, such as salad dressing or ketchup bottles, is not subject to the Bottle Law and so is less likely to be recycled. Given the fact that the flint glass manufacturing process can use a high percentage of cullet--up to 80%--the demand for flint cullet is very strong.

All firms surveyed expressed the need for the cullet to be high quality to be useful, particularly the Canadian firms, which use a larger percentage of cullet. Contamination in the manufacturing process is an incremental problem. That is, 2% paper contamination is not a problem for a mill using only 30% cullet, as this translates to .6% contamination overall. For a mill using 80% cullet, 2% contamination results in 1.6% overall contamination, which is too high.

Cullet produced by a MRF using similar technology to that proposed for the Massachusetts MRFs has produced an acceptable quality, according to the surveyed firms, some of whom use cullet from that MRF. One user stated that one particular advantage of that process is the high degree of plastic removal. Plastic causes small bubbles in the finished glass, and accordingly would not pass the specifications of their customers.

Expansion of the cullet market was seen by some users. The fiberglass industry may increase its use of cullet. One user spoke of a potentially large market for mixed-color cullet.

Preliminary Report on the Marketability of Mixed Paper Recovered From the Massachusetts Waste Stream

Available Demand: 80,000 tons per year

2 MRF output: 38,000

5 MRF output: 95,000

10 MRF output: 190,000

Revenue Per Ton: \$50.00/ton news

\$50.00/ton corrugated

\$25.00/ton mixed

Introduction: The Nature and Desirability of Recycled Paper:

Recycled paper, like glass, is collected in a mixed fashion and then sorted at the MRF. As in the case of glass, paper is sorted into three grades: news, corrugated, and mixed; contaminants are removed; and then the paper is baled. Unsorted, mixed paper is also purchased; unlike different colors of glass cullet, different grades of paper have a limited degree of interchangeability. Baled paper can be sold in this country or abroad. Another option for paper recycling is also available: site the MRF beside an existing paper mill and deliver the paper to the mill directly, without sorting or baling. This method would eliminate some costs.

Surveyed Recycled Paper Users:

North Shore Recycled Fibers, Salem, MA
Willimantic Waste Paper, Willimantic, CT
Sonoco Products Co., Holyoke, MA
Harmon Associates, Westbury, NY

The Market for Recycled Paper:

80,000 tons per year of demand was identified by visiting the first three plants. It should be noted that there are 21 more recycled paper users and export brokers in the New England region. It was also suggested that large export markets exist, and baled paper from the Massachusetts MRFs could tap that market. A fourth firm said that, with adequate notice, they could purchase 300,000 tons per year, which would be the maximum potential output of the MRF system.

Comments:

The export demand for recycled paper fiber is would be an important component of the demand for MRF generated paper. Recycled paper is sought by such rapidly industrializing nations as Mexico, Taiwan, China and South Korea, all of whom need paper in packaging but have relatively small domestic fiber supplies. While some concern was expressed that markets in the Northeast

would have trouble accepting a large amount of paper coming onto the market in a short time, the export markets appear to be strong and expanding. Concentrating on export markets would minimize the impact on prices in local markets.

Quality is also an important consideration. Contaminants such as dust and organic matter must be removed. One mill already uses paper from a MRF using the same technology as is being proposed for Massachusetts, and finds the quality to be acceptable.

One user indicated interest in obtaining paper from a MRF located beside the mill, saving baling costs.

One national brokerage firm, that form the purchasing arm of a major producer, indicated that they could take the entire potential output of the Massachusetts MRF system. They are an integrated company, with a large number of diversified end-user mills, giving them flexibility in purchasing. They would require adequate notice and some say in collection procedures, and would be interested in office paper as well as other grades of paper coming from the MRFs.

Preliminary Market Study: Conclusions and Summary

Conclusions: Markets and MRFs

The most important finding of the market survey is that, as can best be determined in a preliminary survey, a market exists for the amount of recyclables likely to be generated by the MRFs in Massachusetts for the foreseeable future. The following paragraphs compare MRF output and market demand.

The Market for Recycled Tin Cans:

Current demand for tin cans could easily absorb the output of Massachusetts' MRFs for the foreseeable future. In addition, if enough tin cans were recycled, Vulcan Materials, which operates the only detinning plants in the East, indicated that they would consider locating a plant in Massachusetts, reducing transportation costs. Such a plant, with a projected capacity of 120,000 tons per year, could handle the output of 24 MRFs.

The Market For Recycled Glass Cullet:

Current demand for flint glass cullet could easily absorb the output of Massachusetts' MRFs for the foreseeable future. The demand, found to be over 250,000 tons per year, would entail the total potential amount of flint glass cullet in the Massachusetts waste stream. The demand for green glass cullet is not as strong, but could still handle the output of 10 MRFs. The demand for amber glass cullet is not as strong as that for flint glass cullet, but it should be noted that the two largest US markets have not yet been surveyed.

There are five major glass companies in the northeastern U.S., as well as two Canadian companies with mills accessible to the Massachusetts market. Three American and three Canadian companies or brokers have been visited for this study.

The Market for Recycled Paper

Only four of the 24 recycled paper mills and export brokers in the New England region have been surveyed, but already enough demand has been identified to absorb the output of several MRFs. That demand does not include export markets, which, it was indicated to us, are available. If response from the unsurveyed users matches that of those already surveyed, the demand for recycled paper should absorb Massachusetts' MRF capacity for the foreseeable future. One national paper broker indicated that, with adequate notice, they could buy 300,000 tons per year, or the maximum potential output of a fully developed MRF system.

Summary:

It seems clear, as the Bureau has been suggesting, that there is a very large difference between the potential demand for high quality, high volume recyclables, and the kind of low quality, unprocessed, low volume materials which markets have traditionally received from local community recycling programs.



Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Management

April 10, 1985

10 Cambridge Street
Boston
Massachusetts
0202

Ed Cassidy
Marketing Manager
Vulcan Metals Corp.
Birmingham, AL

Bureau of Solid
Waste Disposal

This is to follow up on our meeting of February 11 in which we discussed your company's interest in purchasing tin-plated steel from the Commonwealth's proposed regional recycling projects.

Pursuant to that meeting it is my understanding that your plant in Pittsburg has current capacity to take up to 72,000 tons of crushed, cleaned, delabeled tin-plated steel cans and that your Baltimore plant has 36,000 tons of additional capacity given the material at first matches the quality produced by the materials processing facility in Groton, CT. I also understand that as the tonnage increases the quality will also have to increase, especially the removal of a larger percentage of labels. As we discussed, the technology to accomplish this has already been tested and will be included in the materials recovery facilities to be built in Massachusetts. Finally, it is my understanding that the current market price is in the range of \$60/ton, based on the price of no. 1 steel bundles in Philadelphia.

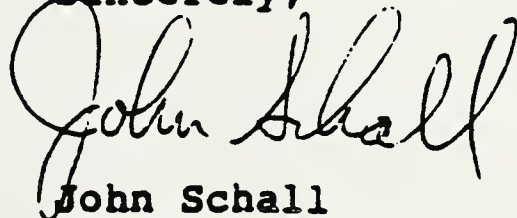
In our meeting, I outlined to you the Commonwealth's plan to create a substantial recycling infrastructure, and to install intermediate processing capacity to process commingled recyclables from communities throughout the State. Each material recovery facility (MRF) will be processing about 20,000 tons of commingled glass and cans, and 20,000 tons of paper per year. The processing will produce roughly 5,000 tons of tin plated steel, 8,000 tons of flint cullet, 4,000 tons of green cullet, and 3,000 tons of amber cullet in addition to the 20,000 tons of mixed paper.

The plan is in the final stages of development, and we are proceeding with preliminary development activities for the first two MRFs. At this time, based upon our conversation, I would like to request a letter of interest to purchase materials from the Commonwealth-sponsored MRFs. This is not a binding letter. However, to complete our market report, I would like your firm

to reiterate what we discussed in our meeting in a letter. Please address your immediate and long-term capacity, both satisfied and unsatisfied, the specifications for the material, freight arrangements, and other relevant factors.

Thank you for your promptness in replying with a letter of interest. Please feel free to contact me at 617-727-3260, if you have additional questions.

Sincerely,

A handwritten signature in cursive script that reads "John Schall". The signature is written in dark ink and is positioned above the typed name.

John Schall
Recycling Director
Bureau of Solid Waste

Vulcan Materials Company

METALS DIVISION / 4100 GRAND AVENUE • PITTSBURGH, PA 15225 • TELEPHONE 412-331-0770 • TWX 710-664-2003

APR 29 1985

Bureau of Solid Waste Disposal

April 16, 1985

Mr. John Scall
Recycling Director
Bureau of Solid Waste
100 Cambridge Street
Boston, Massachusetts 02202

Dear Mr. Schall:

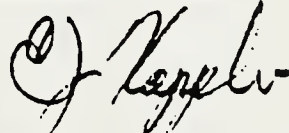
Dave Cassidy asked me to respond to your letter of April 10, 1985. Vulcan Materials Company is interested in purchasing the tin-plated steel cans from the Commonwealth of Massachusetts' proposed regional recycling projects. The quality of the material produced in Groton is better suited currently to our Pittsburgh plant. However, the long-term market would be our Sparrows Point, Maryland plant which would require a marked improvement in label removal. Our established policy is to accept clean, de-labeled, flattened tin coated food cans which have at least one end removed. We do not accept beverage cans which are bi-metal. Large capacity trucks must be open top or dumps.

The price we pay is dependent upon the steel market in Philadelphia, although it does not correlate directly. Vulcan's prices are F.O.B. our plants in open top rail cars, open top trailers, or dump trucks. This type of material has been the least desirable raw material of our plants due to the inherent contamination and, therefore, our prices reflect that reality. Currently, we are paying \$50 to \$55 per gross ton (2240 pounds) for this material. Historically, that price has varied from \$30 to \$95 depending upon the scrap market. Our standard practice with new suppliers is to quote monthly prices until a consistent quality and volume has been established. At that point, we are willing to offer up to a one year contract.

Our immediate capacity shortfall is approximately 4,000 to 6,000 gross tons per month. Once that is satisfied, other long-term capacity considerations would have to be made. I want to assure you, however, that if you can meet our specifications we will purchase all that you can produce. Please call me if you have any questions.

Sincerely,

VULCAN MATERIALS COMPANY
Metals Division



Edward J. Kappler
Regional Purchasing Manager

EJK/sf

cc: Dave Cassidy, Bob Cooper, Bill Germain, R. U. Johnson, John Davis



FOSTER-FORBES GLASS DIVISION

Manufacturer of Glass Containers Since 1911

April 22, 1985

Mr. John Schall
Recycling Director
Bureau of Solid Waste
Commonwealth of Mass.
Dept. of Environmental Mgt.
100 Cambridge Street
Boston, Mass. 02202

Dear Mr. Schall:

Relative to your April 10th letter:

1. Our plant currently can take approximately 45,000 tons of cullet at a price of \$40.00 per ton delivered.
2. The 100,000 tons would be based upon our ability to run 100% cullet. We would certainly move in that direction given the quality and successful operation at the higher levels.
3. Specifications for the material include exclusion of any type metal in the broken glass.
4. We have received cullet from the processing plant in Groton, CT. and find their product completely satisfactory.
5. In addition to the above, we currently have an idle furnace. This furnace, if rebuilt, could produce another 90,000 tons of glass per year.

You can see Mr. Schall that our immediate need and long range potential, although not binding upon our company, is indeed interesting. I must remind you, however, that the delivered price of \$40.00 per ton is a very important part of our interest.

We think the Commonwealth is on the right track with recycling and believe it to be a safe and cost effective resolution of the solid waste crisis facing our municipalities.

Alfred R. Camp,
Plant Manager

ARC/ptc

cc: J.R. Woods, NCC
H. Thompson, FFMI

**Questions and Answers About
The Regional Recycling Strategy**

Questions and Answers about The Regional Recycling Strategy

Q: What exactly is recycling?

A: Recycling is the return of used material to the economic mainstream. In this plan, such items as: 1. glass bottles and jars, together with tin and aluminum cans; 2. newspapers, magazines and other types of paper will be collected for re-use by industry. Recycling can also be called "materials recovery."

Q: Why is recycling being proposed as a waste management strategy?

A: Recycling has a number of advantages:

a: It's cost-effective. A high-volume recycling program, such as the one proposed for Massachusetts, can save money for municipalities in two ways. First, the municipality will avoid the tipping fees charged by landfills. (Landfill costs across the state are rising; commercial landfills are currently charging \$25 per ton, and that's an increase of 25% over February prices. Prices will continue to rise dramatically.) Second, the municipality will be paid for each ton of recyclable material brought to the recycling facility. The net savings for a town of 50,000 which recycles 15% of its trash through the state-sponsored regional programs (and was paying \$30 per ton to dump its trash at a commercial landfill or resource recovery plant) will be approximately \$162,000.

b. It's environmentally sound. The problems associated with the other main disposal methods--landfills and waste-to-energy plants--are well-documented. Landfills frequently pose a threat to groundwater, and waste-to-energy plants have air emissions problems. In addition, figures show that landfills are quickly reaching their capacity. At the same time, environmental concerns, as well as rising real estate costs, have virtually halted the opening of new landfills.

Q: Isn't recycling just a fund-raiser for such groups as schools, churches, and community groups?

A: Recycling has been successfully used by those groups in the past, but it has far greater potential. The state's plan would avoid the two problems which limited those programs: low volume and uneven quality. Small programs seldom generate enough volume to secure long term markets, and also the raw, unprocessed recyclables hold the price down. Industries do want recyclables--

if the glass and cans are cleaned and crushed, and the paper is baled or otherwise prepared.

The key to this new approach to recycling is the Materials Recovery Facility, or MRF. The MRF takes in recyclables from municipalities, processes them to meet the requirements of industry, and then markets them. That way, both the high volume and the high quality required to successfully market recyclables can be generated.

Q: How can municipalities in a particular region take advantage of the high-volume, high-quality state program?

A: The first and most important step is the passage of a recycling ordinance. That ordinance should state two basic requirements: first, that residents and businesses separate recyclables--glass, tin and aluminum cans, and paper--from the rest of their trash; second, that the recyclables placed at the curb become the property of the municipality or waste hauler that is running the collection program (another requirement for a municipality to participate is to put a collection program into place, either using the municipal workforce or contracting with a private hauler to collect the recyclables); third, the collected recyclables are delivered to the nearest MRF.

Second, the municipality must help educate its citizens about the benefits of recycling. The Commonwealth will provide assistance with educational materials and programs. Public education is crucial. If people don't get behind recycling, and separate out their recyclables, the program simply won't work.

Q: Isn't source separation too much trouble for the individual?

A: No. People themselves have proved this notion false by cooperating in large numbers. Studies have shown that people in a community with a recycling ordinance do separate their waste. And it's not a tough task: glass and cans are put in one bag, papers in another, and the rest of the trash in a third. It takes the effort of one family member for about ten minutes per week--less than the time it takes to sort our dishes each night or our laundry after it is washed. Recycling in this manner is quick and easy.

Q: Has this kind of program worked in other places?

A: Yes. Oregon and New Jersey both have state-wide recycling programs. While Oregon's is still getting underway, New Jersey's

has been operating for two years. In 1983, the return to the participating communities was substantial: \$12 million in sales revenues, \$18 million in averted disposal costs, and \$3.5 million in state rebates and grants. And New Jersey's program is growing as more communities see the benefits. The number of participating communities rose more than 25% from the first year to the second and the amount of waste recycled almost doubled. There are also case histories of successful programs in cities large and small across the country.

Q: What's the state's commitment to the plan?

A: The state will help out in four ways. First, the state will build the MRFs, the key to the program. Second, the state will help municipalities educate their communities about recycling by providing programs and materials. Third, the state will provide technical assistance in setting up curbside collection programs. Fourth, the state will provide to help purchase any needed equipment.

Q: Who markets the finished recyclables?

A: The operator of the MRF, a contractor hired by the state, will do the marketing. After a number of MRFs are operating, the state will organize a marketing co-op to increase the MRFs clout in the marketplace.

Q: Who gets the profits?

A: They're shared between the state (to repay the capital cost of building the MRF), the operator (as an incentive) and the participating municipalities.

Q: When is the state going to build the MRFs?

A: As soon as enough municipalities decide to participate. To make a MRF economically viable, a certain volume of incoming recyclables is needed. Commitment is required on both sides: the municipalities commit themselves to providing the recyclables, and the state commits itself to building the MRFs that will process those recyclables and market them to industry.

Q: Is there a stable market for recyclables? Won't commodity price fluctuations threaten the municipalities' revenues?

A: Studies by the Bureau of Solid Waste Disposal have found that a strong market demand exists for recycled glass, tin, aluminum, and paper in the quantities this program will generate. And recyclables are frequently more cost-effective than "virgin" materials for use in industry: they are cheaper, require less energy in the manufacturing process, and are more readily

available than virgin materials. Tin cans are particularly valuable. Recycled tin cans are the only domestic source of tin, and the steel left over when the tin is separated out is highly valued by the steel industry, because it melts at a lower temperature than virgin ore. The high volume of the MRF output and the ability to reach more distant markets, will over time insulate the municipalities from price fluctuations, which were frequently a result of having to deal with only the nearest plant or mill, and not the one offering the best price.

Q: But glass, tin, aluminum and paper are commodities, and the demand must vary widely. Isn't this a risky venture?

A: Not necessarily. The MRFs can be economically viable even at low volumes. For instance, a plant with a capacity of 40,000 tons per year of recyclables can operate on a break-even basis with a far lower volume, only 16,000 tons per year, or less than half.

Q: Why can't we leave this to the private sector, if it's such a good idea?

A: Recycling isn't really a money-making venture. Yes, there is some profit in good times. But the other benefits to the state and the municipalities--avoiding landfill tipping fees, conserving scarce landfill capacity, and the long-term benefit of a better environment--aren't things that a private business could profit from. Secondly, the program requires a long-term commitment, for weak economic times as well as the strong. A municipality must continue to get rid of its garbage, whether the market for recyclables is strong or weak. Third, the private sector will have some role, in managing and operating the MRFs and marketing the processed recyclables. The sharing of profits with the operator will be an incentive for good operation.

Q: Can't a municipality do all this on its own?

A: No, unless the municipality is very large. For most municipalities, the investment required for the construction of a MRF is excessive. Also, industrial users want a higher volume than most municipalities can provide. But state-municipality cooperation will provide the volume and quality that will make a program work.

Q: If recycling is such a great idea, why hasn't it worked before?

A: Most municipal recycling programs were conceived and financed (if they were financed at all) out of concern for

conservation and the environment. Their operations and personnel were not connected to the solid waste system at all. Their scale was small, so that the amounts of materials were only of limited interest to markets. When the economy was strong, markets could afford to take small quantities of materials requiring special handling, and the revenues were used to run the programs. All this was true until recently.

Programs like this were not protected against a worsening of the economic climate. When revenues fell, municipal or non-profit operators could not continue the operations. End-users decided that the small accounts were unreliable, and lost interest.

The costs of disposal, also, were not perceived to be high. So programs did not attract interest as a means of lowering overall solid waste management costs. Without crossover support from avoided disposal costs, many municipal programs folded either in the paper market downturn of 1981-82, or in the contraction of the glass industry between 1983 and the present. The proposed state program addresses each of these problems.

Q: What about existing programs that are doing well on their own?

A: There's no obligation to join the state program, but there will be benefits to joining. Programs marketing unprocessed recyclables will be able to receive a stable price for their materials from the MRF if they so choose, and thus avoid the necessity of further marketing efforts. Programs marketing processed recyclables could join the state's marketing efforts and get a potentially better price, as well as access to more distant markets.

Q: How does a MRF work?

A: It's a technique known as "positive selection". Glass, tin, and aluminum recyclables pass through the MRF on a conveyor belt. As they pass, workers pick out specific items: one worker picks out green glass, another picks out amber, while a third picks out clear or "flint" glass. Another worker picks out the aluminum, while a large magnet picks out the tin. Glass then goes to a crusher, where it is reduced to small pieces called "cullet", and labels, rings and caps are removed. Tin cans are de-labelled as they are flattened. Paper is sorted into several grades, and then baled or shipped loose to a mill. The state has already chosen this methodology, but a specific vendor has not been selected.

Q: Is this a proven method?

A: Yes. It was pioneered by a company in Connecticut. It's use has spread to a number of programs across the country. These programs get high marks from the

glass, de-tinning and paper industries for the quality and consistency of their materials. No vendor would be successful unless they could demonstrate that they had achieved a high level of reliability and end-user industry acceptance.

Q: Is a MRF safe and pleasant for workers?

A: Like any plant, a MRF can be managed either well or poorly. The type of selection work performed is not physically taxing. To ensure worker health and safety, gloves and goggles must be worn by all in the plant. Dust control is achieved either through ventilation systems, or by wetting the glass (the only source of dust) as it enters the crushers.

Q: Who will own the MRFs?

A: The first two will be owned by the state, which will provide the capital under existing funds from the Solid Waste Bond Act. Additional MRFs will be funded out of pending solid waste legislation. But it won't be a monopoly. Municipalities, individually or in groups, or private concerns, may also build MRFs, and take advantage of the technical assistance, public education, and tonnage allowances that the Commonwealth will provide to regional programs.

Q: Who will operate the MRFs?

A: Operation of MRFs owned by the Commonwealth will be put out to bid. A number of firms have already expressed interest. Bidders will be able to bid on a number of options, including paying a lease fee, providing for profit-sharing, collecting an operator's fee, and other feasible arrangements. Specifications for finished materials quality, worker health and safety, environmental and zoning regulations, detailed accounting, open books and other criteria will have to be met by the successful bidder.

Q: Isn't this a lot of trouble to implement--building MRFs and passing recycling ordinances? Why can't we just keep on putting our garbage in landfills?

A: Sure, we can keep putting our garbage in landfills--if we can afford it. Massachusetts is rapidly running out of landfill space. By 1988, we will be producing twice as much garbage as our landfills can take. As landfill capacity is reduced, and the amount of waste generated stays the same, the law of supply and demand will take over. Tipping fees (the charge for dumping trash at a landfill) have been increasing rapidly, and with demand rising faster than supply, that's not going to change. A municipality can either pay to dump its recyclables in a landfill, or it can get paid to bring them to a MRF. And that's a difference of about \$40 per ton.

Q: Why can't we just open more landfills?

A: Two reasons: cost and pollution. Given the poor record of landfills (groundwater pollution, for one) few municipalities (and few voters) want to open landfills near their water supplies. Second, while safe landfills can be constructed, they're expensive--and so are the large number of acres needed to accommodate a landfill. MRFs, on the other hand, pay a municipality to bring in its recyclables. Recycling's more than just a sound environmental idea: it makes good economic sense.

Q: Is the Commonwealth's commitment to recycling limited to financing the regional recycling programs?

A: No. In addition to the regional recycling programs, the state will promote and expand the already existing state office white paper program into municipal and private office buildings. It will provide technical assistance to communities to develop additional programs targeting non-MRF materials such as yard and food waste, tires and plastics among others. It will develop an extensive recycling education and promotion campaign across the Commonwealth to inform and educate its citizens of the economic and environmental value of recycling. Finally, it will help develop a statewide institutional infrastructure to insure the effectiveness of recycling is maintained over time.

Massachusetts Recycling Report

I. Introduction

Recycling is an old idea which is finally beginning to receive the attention it deserves. Historically, recycling has occurred out of necessity during times when raw materials have been scarce. For instance, the extensive rationing during World War II prompted industry to recycle and reuse up to 25% of the total solid waste stream.

The first major recycling effort inspired by an environmental consciousness began in the late 1960s. During this time, self-described ecologists and concerned citizens developed local recycling programs. Municipal and state officials showed little interest in encouraging this "good samaritan" behaviour. The Cub Scouts and League of Women Voters could worry about the local recycling program--- they had hundreds of thousands of tons of garbage to pick up and dispose of in their local, out of the way landfills.

Times have changed. Massachusetts is facing an environmental crisis which is forcing the state to change its past trash disposal policies. More than 60% of the state's landfill capacity will be exhausted in three years. Toxic chemicals from landfills are leaching into underground water supplies. Once contaminated, groundwater remains contaminated for decades. Groundwater is a source of drinking water for over half of Massachusetts' residents.

The environmental problems of landfills have led to an increasing reluctance to site new ones. One alternative is waste-to-energy facilities, which burn trash to produce either steam heat or electricity. While these facilities are preferable to poorly run landfills, they are expensive and not without their own environmental concerns.

Local and state solid waste disposal officials are now reevaluating the principles that past recycling practices were based on. It has become increasingly clear that recycling is a crucial part of an economically beneficial and environmentally sound solid waste disposal strategy. The Bureau of Solid Waste Disposal has made recycling an essential part of a proposed overall solid waste management plan for the state of Massachusetts.

II. What Is Recycling?

Recycling is a process by which items that would otherwise become garbage are diverted from the waste

stream, collected, processed, and then reintroduced into the manufacturing process as raw materials.

Recycling begins when a resident or business separates items from the trash and either places them out for collection or takes them to a recycling center. From the recycling depot, the recyclables are taken to a place where they can be processed into raw materials for purchasing industries.

Plants that process recyclables are known as "materials recovery facilities". These plants purchase trash that has been separated into paper, glass bottles, and tin and aluminum cans. The facility bales the paper and sells it to paper mills or de-inking plants, or exports it. It sorts, cleans and crushes the glass and tin products. These raw materials are then sold to "end user" markets. Industries choose to purchase recyclables or secondary materials over virgin materials because they:

- *are less expensive

- *require less energy in the manufacturing process

- *are more readily available than virgin materials.

A materials recovery facility is an important component of effective recycling programs because it guarantees a market for local communities' recyclables. A MRF in Groton, Connecticut pays \$4 per ton for mixed recyclables.

III. Recycling in Massachusetts

Recycling methods within Massachusetts are numerous and varied. Some industries, such as scrap metal dealers, specialize in collecting, processing and selling secondary materials. Others recycle large quantities of corrugated cardboard and sell this back to local paper mills. Roughly one-eighth of all the newspaper produced in the state is recycled.

Approximately 70 communities in the Commonwealth have some form of local recycling program, ranging from cub scout paper drives to municipally mandated source separation and curbside collection. The Bottle Bill has unquestionably been the factor that has most significantly influenced recycling in Massachusetts. An estimated 85 percent of all beer and soda containers are currently being returned to stores and redemption centers, thus averting roughly 250,000 tons of waste from landfills.

Despite the existence of many different recycling options in the Commonwealth, recycling as an effective solid waste disposal practice has, until now, been quite minimal.

Massachusetts generates 6 million tons of municipal and commercial solid waste each year. The Bottle Bill has been responsible for recycling roughly 4 percent of that total. All other recycling options combined account for less than 1 percent. Recycling, therefore, eliminates at a maximum only 5 percent of the total waste generated in the State.

IV. What Could Be Recycled?

As much as 60-70% of the state's total waste stream could be recycled. 20-25 percent of the total waste stream is comprised of newspaper, corrugated cardboard, office white paper, and various grades of mixed paper. Non-beverage glass containers account for 8%, tin cans and other ferrous scrap metal for 5%, and nonferrous metals like aluminum and copper for 1-2%. Additional potential recyclables, such as used oil, tires, certain plastics, textiles, and discarded appliances called "white goods", make up another 5%. Finally, food and yard waste that can be turned into a form of fertilizer called compost, comprise 20-30%.

Recycled paper has many different uses. Old newspaper is turned back into newsprint at 6 large de-inking paper mills in the country. Old corrugated is turned into new corrugated at hundreds of paper mills, many of which are in the Northeast. Paper board used for packaging boxes, toilet paper and paper towels are made out of mixed grade paper. High grade office white paper can be recycled into stationary and xerox quality office paper. Finally, mixed grade paper can be turned into blown insulation material.

Used glass is cleaned and crushed to make "cullet". It is considerably cheaper to make glass containers out of cullet than out of virgin materials. Fiber-glass, building construction and road paving materials can also be made from cullet.

Used tin cans are equally valuable: they provide the only domestic source of tin in the U.S. The cleaned, crushed steel that remains after the tin is removed is highly sought by steel mills, since it melts at much lower temperatures than virgin ore.

Aluminum is the most valuable recyclable. The aluminum industry has developed extensive markets to purchase as much used aluminum as possible. Prices for used aluminum range from \$500-700/ton.

Paper, bottles and cans are the most common recyclables. However, many other types of waste can be recycled as well. Crumb rubber plants process used tires into paving and construction material. Oil rerefining plants convert used oil

into heating fuel and new high quality motor oil. Finally, the composting of both food and yard waste, which together account for about 25% of the waste stream, can produce both fertilizer and top soil replacement. The U.S. Forest Service has stated that top soil may be our most endangered raw material within the next ten years.

V. The Economic and Environmental Benefits of Recycling

The economic advantages of recycling are dramatic. For every ton of waste recycled, one less ton of waste needs to be disposed of at landfills. This saves a community about \$30 per ton, the average tipping fee at landfills and waste-to-energy facilities in Massachusetts. In addition to this averted cost, the sale of recyclables to intermediate processing facilities generates revenues of \$5 to \$6 per ton. Finally, recycling averts the capital cost of providing additional landfill capacity or waste-to-energy capacity. A town of 50,000 that contracts out collection and disposal costs, could save over \$160,000 a year by recycling 15% of their waste stream.

Recycling is the most environmentally sound solid waste disposal option. Leachate from landfills without liners and collection systems poses a serious threat to underground water supplies. Costly state-of-the-art landfills reduce, but do not eliminate, this risk. Waste-to-energy facilities require expensive pollution control devices to reduce the health hazards of emissions. Recycling plants present none of these environmental risks.

Resource conservation is another benefit of recycling. In addition to conserving virgin materials such as wood, iron ore, bauxite, tin, oil and rubber, the use of secondary materials provides a dramatic energy savings. The most striking example is aluminum, which requires 90 percent less energy to manufacture from recycled material than from virgin material. According to an EPA report, in 1977 7 percent of the total U.S. solid waste stream was recycled, at an estimated energy savings of 50,520 billion kilowatt hours, or one percent of total U.S. energy requirements. If recycling increased to 25 percent, the U.S. energy savings would be close to 4 percent.

VI. Problems Requiring Solutions

If recycling is such a great solid waste disposal option, then why has it been so hard to integrate into solid waste disposal plans on both the local and state level? As with most good ideas, recycling is not without its implementation problems.

Small, local recycling programs that operate on a voluntary basis face a number of obstacles. Chief among these is finding

markets for their recycled materials. There are generally two problems with the secondary materials from small, local recycling programs. They are often of very low quality: glass colors are mixed, porcelain and other impurities are mixed in with the glass, and tin cans are not cleaned or crushed. Industries are anxious to use high quality secondary materials, but will purchase virgin materials over low quality recyclables. Secondly, the cost of transporting relatively small quantities of recyclables is prohibitive. In addition, the small markets that most local programs sell to are sensitive to the economic fluctuations that accompany the business cycle, and are therefore not always dependable. Maintaining effective collection procedures and adequate storage facilities poses another potential problem for small recycling programs.

VII. Can These Problems Be Resolved?

A number of states and hundreds of communities across the country have overcome these problems in interesting and creative ways. The following section describes some of the more significant of these working examples, focusing on the two major ongoing statewide recycling programs, which are in Oregon and New Jersey.

OREGON

The Oregon program is based on a legislative bill called "The Oregon Opportunity to Recycle Act." This act states that by July of 1986 every citizen in Oregon must be provided with "the opportunity to recycle." This includes at a minimum:

- o Recycling depots located at every waste disposal facility or at a place more convenient to the population being served.
- o Curbside collection of recyclables at least once a month in communities of over 4,000 people.
- o An outreach and educational campaign informing each community how their opportunity to recycle is being provided.

What constitutes a "recyclable" in Oregon is determined by an economic calculation. Any item or group of items whose net cost of recycling is less than or equal to the cost of collection and disposal is defined as a recyclable. This determination reinforces the fact that the economic advantages of recycling include both the revenues gained plus the disposal costs averted. However, it leaves open to divergent interpretation what does or does not constitute a recyclable.

The collection and marketing of recyclables in Oregon will rest almost entirely in the hands of the waste haulers. 99 percent of all Oregon communities have private trash collection. Local communities regulate fees and hauling procedures. Thus, the local haulers will be responsible for complying with the opportunity to recycle provisions of the Oregon Act. It appears that they have willingly accepted. The haulers in over 85 percent of the communities in Oregon have already begun at least once a month curbside collection. In addition, they have formed "recycling associations" which are planning the construction and operation of processing centers and marketing co-ops.

Finally, the State has reserved the right to mandate source separation and collection of recyclables wherever the goals and objectives of the Act are not being met.

NEW JERSEY

New Jersey's recycling program is based on a \$.12/cubic yard tipping fee charged for all waste disposed of in New Jersey landfills. This fee generates about \$5 Million. 45 percent of this fund is returned to communities based on the number of tons of materials they recycle. An additional 40 percent of this fund is used for community's recycling program development and education grants, loans to recycling businesses, and to defray the local expenses of running recycling programs. 15 percent is used for the operating expenses of the State Office of Recycling, the agency created to carry out this program.

New Jersey has increased the financial incentive for communities to recycle. In addition to the averted disposal costs and the revenues gained from the sale of recyclables, New Jersey communities receive a rebate of about \$8 for every ton of recycled material.

The New Jersey recycling program has been in effect for two years. During the first year, approximately 250 out of New Jersey's 560 communities recycled 350,000 tons of waste. In the second year, 320 communities recycling almost 600,000 tons participated in the rebate program. In 1983 the financial return to New Jersey communities participating in this recycling program was \$12 million in sales revenues, \$18 million in averted disposal costs and another \$3.5 million in state rebates and grants.

The recycling experience in New Jersey exemplifies the effectiveness of locally mandated versus voluntary recycling programs. Of the 320 communities with recycling programs in New Jersey, almost 100 have locally mandated source separation and collection programs, which account for over 75 percent of the total tons recycled. Although recycling is a proven success in many New Jersey communities, many are still not participating. To address this problem, New Jersey has proposed a state mandated source separation and collection program to supplement their rebate system.

The major criticism of the new New Jersey plan is that it fails to address how the greatly increased supply of recyclables generated by this mandated program will be marketed.

New Jersey and Oregon are not the only recycling success stories. In 1979, 117 recycling operations in the State of Washington recycled 478,000 tons of materials valued at \$26 million; These recycled materials represent energy savings of 2 billion kilowatt hours; over \$20 million accrued to local communities in the form of solid waste disposal savings; and the employment of 1500 people.

Similar stories can be told for many other cities across the country. These include: Minneapolis, St. Paul; Seattle; Fresno, CA; Austin, TX; Berkeley, CA; Boulder, Co. and Newark, N.J. The experience and knowledge gained from these programs can be brought to bear on the development of local and statewide recycling programs in the Commonwealth.

